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ABSTRACT

A new form of the Purdue Elementary Problem Solving Inventory which presents real-life problem situations as three-dimensional models is described and developmental data is presented. Second and fourth graders in an advantaged and a disadvantaged school were given either the model version or the original slide version of the Inventory. The model version was found to be an internally consistent, equivalent form of the original Inventory. The KR-20 for the combined sample was .64 for both the model and the slide versions. Also, a coefficient of equivalence for students taking both forms of the Inventory was .73. (Author)

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Development of a Problem Solving Inventory Involving Three-dimensional Models of Problem Situations

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A new form of the Purdue Elementary Problem Solving Inventory which presents real-life problem situations as three-dimensional models is described and developmental data is presented. Second and fourth graders in an advantaged and a disadvantaged school were given either the model version or the original slide version of the Inventory. The model version was found to be an internally consistent, equivalent form of the original Inventory. The KR-20 for the combined sample was .64 for both the model and the slide versions. Also, a coefficeint of equivalence for students taking both forms of the Inventory was .73.

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Objective

The purpose of this paper is to describe the development of a new form of the Purdue Elementary Problem Solving Inventory which presents real-life problem situations as three-dimensional models and to present some developmental data.

Several guidelines used in the construction of the original form of the Inventory were also instrumental in the designing of a format involving three-dimensional models (Feldhusen, Houtz & Ringenbach, in press). The first of these is that problem solving is a multifaceted process, composed of a variety of related abilities, each of which can be measured separately. A second guideline is based on the position that problem solving should be meaningful for the examinee (Cronbach, 1955; Keislar, 1969), and that problems which are put into realistic contexts will yield more valid measures of problem solving ability than those phrased in more abstract terms (Simon, 1970). The final guideline involves the reduction of the verbal and memory components of the abilities measured in an attempt to minimize cultural biases often associated with verbal skills (Davis, 1948).

In light of these guidelines, one of the major contributions which the model version makes is in the area of realism. An increased emphasis is placed on the three-dimensional aspects of the problem situations. Spatial relationships which were only implied in the two-

dimensional cartoons of the original slide version are more obvious in the model version, due to the increased number of perceptual cues. Also, in contrast to the black and white slides, color has been added to all aspects of the models, thus greatly increasing the degree of realism.

Method

As a basis for the new three dimensional version, a shortened form of the original inventory was constructed using 25 items which had the best difficulty and discrimination levels. An artist was then commissioned to make models of the problem situations for each item in the shortened form of the Inventory.

The models are each constructed on a base 12 by 24 inches and range up to 18 inches high. Figures of children in the problem solving situations are represented as cutouts, enlarged from the original cartoons, which stand up in the foreground. Other props such as tables, chairs, or other aspects of the problem situation were constructed out of cardboard and made to appear three-dimensional. A firm cardboard background is attached to each model and completes the scene by showing all additional details necessary to set thelocation of the problem solving situation.

A stage was also constructed with an opening somewhat similar to that of a puppet stage, where one model can be viewed at a time. Panels were joined to either side of the stage to effectively conceal all other models and also the person behind the scenes during test administration. All directions, item stems and response options are recorded on tape and played for examinees who respond in a booklet.

Data Source

A trail run of the model version was conducted with second and third graders. No procedural difficulties were encountered and the viewing angle of the stage was set so that all students could see the models clearly from their desks. The model version and also the shortened slide version was then administered to a sample of 98 second and fourth graders from an advantaged and a disadvantaged school in Indianapolis, Indiana.

Results and Conclusions

A measure of internal consistency was obtained for all students taking the model version, resulting in a KR-20 of .64, which was the same as that for the slide version. No difference in internal consistency was found between the two forms at the advantaged school. However, in the disadvantaged school, the KR-20 for the slide version was .63, or somewhat nigher than the .49 for the model version. This difference appears mainly in the fourth grade sample and can be seen from the item analyses to be due to a general disagreement on the correct answer for several items. Although the discrepencies in these items should be investigated before the model form is used with disadvantaged groups at this grade level, other evidence shows a strong similarity between the two forms.

Students at the advantaged school who had taken the model version of the Inventory were retested after about two weeks on the slide version. Coefficients of equivalence between the two forms ranged from .84 for second grade to .69 for fourth grade, or .73 for the combined sample. Also, the general pattern of responses, as shown by the proportion of students choosing each alternative, changed markedly between the original

form and the model version on only three of the twenty-five items. Mean item difficulty for the model version of the Inventory in the advantaged school was .67, as compared to .68 for the slide version in the same school. However, a greater difference did appear in mean item difficulty within the disadvantaged school. The model version was somewhat more difficult, with a mean item difficulty of .57 compared to .64 for the slide version. This difference was once again mainly at the fourth grade level.

Implications

To date, the model version of the Purdue Elementary Problem Solving Inventory appears to be an internally consistent, equivalent form of the original slide version. However, further investigation into its use with disadvantaged populations seems to be merited. In particular there is a need to determine the validity of the three dimensional form as a measure of problem solving ability as compared with the original form of the test.

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